

## PCT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner  
 US Department of Commerce  
 United States Patent and Trademark  
 Office, PCT  
 2011 South Clark Place Room  
 CP2/5C24  
 Arlington, VA 22202  
 ETATS-UNIS D'AMERIQUE  
 in its capacity as elected Office

Date of mailing (day/month/year) 07 May 2001 (07.05.01)	
International application No. PCT/SE00/01630	Applicant's or agent's file reference 00-1133/IJW
International filing date (day/month/year) 24 August 2000 (24.08.00)	Priority date (day/month/year) 24 August 1999 (24.08.99)
Applicant BORG, Thomas	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:  
 12 March 2001 (12.03.01)

☐ in a notice effecting later election filed with the International Bureau on:  
 \_\_\_\_\_

2. The election ☒ was

☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Claudio Borton Telephone No.: (41-22) 338.83.38
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Express Mail No.: EL230048360US

1-03-09

WO 01/14689 18  
PCT/SE00/01630

## PATENT COOPERATION TREATY

PTO/PCT Rec'd 21 FEB 2002  
PCTNOTICE INFORMING THE APPLICANT OF THE  
COMMUNICATION OF THE INTERNATIONAL  
APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

From the INTERNATIONAL BUREAU

To:

KARLSSON, Leif  
L.A. Groth & Co.KB  
Box 6107  
Västmannagatan 43  
S-102 32 Stockholm  
SUÈDE

Date of mailing (day/month/year)

01 March 2001 (01.03.01)

Applicant's or agent's file reference

00-1133/IJW

## IMPORTANT NOTICE

International application No.

PCT/SE00/01630

International filing date (day/month/year)

24 August 2000 (24.08.00)

Priority date (day/month/year)

24 August 1999 (24.08.99)

Applicant

ATLAS COPCO CRAELIUS AB et al

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:  
AU,KP,KR,US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:

AE,AG,AL,AM,AP,AT,AZ,BA,BB,BG,BR,BY,BZ,CA,CH,CN,CR,CU,CZ,DE,DK,DM,DZ,EA,EE,EP,ES,  
FI,GB,GD,GE,GH,GM,HR,HU,ID,IL,IN,IS,JP,KE,KG,KZ,LC,LK,LR,LS,LT,LU,LV,MA,MD,MG,MK,  
MN,MW,MX,MZ,NO,NZ,OA,PL,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TR,TT,TZ,UA,UG,UZ,VN,YU,  
The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on 01 March 2001 (01.03.01) under No. WO 01/14689

## REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

## REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO  
34, chemin des Colombettes  
1211 Geneva 20, Switzerland

Authorized officer:

J. Zahra

Facsimile No. (41-22) 740.14.35

Telephone No. (41-22) 338.83.38

International application No.

PCT/SE 00/01630

**A. CLASSIFICATION OF SUBJECT MATTER**

**IPC7: E21B 25/00**

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

**IPC7: E21B**

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

**SE,DK,FI,NO classes as above**

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**EPODOC, WPI**

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3777826 A (WOLDA), 11 December 1973 (11.12.73) --	1-10
A	GB 992246 A (JOY MANUFACTURING COMPANY), 19 May 1965 (19.05.65) --	1-10
A	US 5799742 A (SOINSKI ET AL), 1 Sept 1998 (01.09.98) -- -----	1-10

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

\* Special categories of cited documents

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

**1 December 2000**

Date of mailing of the international search report

**07 -12- 2000**

Name and mailing address of the ISA/  
Swedish Patent Office  
Box 5055, S-102 42 STOCKHOLM  
Facsimile No. +46 8 666 02 86

Authorized officer

**Christer Bäcknert / JA A**  
Telephone No. +46 8 782 25 00

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.

PCT/SE 00/01630

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
US	3777826	A	11/12/73	AU	476842 B	07/10/76
				AU	4525072 A	07/02/74
				BR	7206134 D	00/00/00
				CA	967142 A	06/05/75
				DE	2238186 A	22/03/73
				GB	1369340 A	02/10/74
				NL	7212164 A	19/03/73
				SE	400806 B,C	10/04/78
				ZA	7205122 A	25/04/73
				ZM	12672 A	24/04/73
-----						
GB	992246	A	19/05/65	NONE		
-----						
US	5799742	A	01/09/98	AU	3840097 A	30/04/98
				US	5992543 A	30/11/99
				US	6019181 A	01/02/00
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Express Mail No.: EL230048360US

## PATENT COOPERATION TREATY

PTO/PCT Rec'd 21 FEB 2002

PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P 00-1133 IJW/uh	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/SE00/01630	International filing date (day/month/year) 24.08.2000	Priority date (day/month/year) 24.08.1999
International Patent Classification (IPC) or national classification and IPC E21B 25/00		
Applicant Atlas Copco Craelius AB et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 3 sheets, including this cover sheet.
- ☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of \_\_\_\_\_ sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 12.03.2001	Date of completion of this report 23.11.2001
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer Christer Bäcknert / MRO Telephone No. 08-782 25 00

Form PCT/IPEA/409 (cover sheet) (January 1998)

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/SE00/01630

## I. Basis of the report

## 1. With regard to the elements of the international application:\*

- ☒ the international application as originally filed
- ☐ the description:  
 pages \_\_\_\_\_, as originally filed  
 pages \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☐ the claims:  
 pages \_\_\_\_\_, as originally filed  
 pages \_\_\_\_\_, as amended (together with any statement) under article 19  
 pages \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☐ the drawings:  
 pages \_\_\_\_\_, as originally filed  
 pages \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☐ the sequence listing part of the description:  
 pages \_\_\_\_\_, as originally filed  
 pages \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

## 2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language English which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☒ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

## 3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheet/fig \_\_\_\_\_

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).\*\*

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

\*\* Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/SE00/01630

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. Statement**

Novelty (N)	Claims	<u>1-10</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-10</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-10</u>	YES
	Claims		NO

**2. Citations and explanations (Rule 70.7)****Documents cited in the International Search Report:**

1. US 3777826 A
2. GB 992246 A
3. US 5799742 A

These documents represent background art.

The invention defined in claims 1-10 is not disclosed by any of these documents.

None of the cited documents gives any indication towards the claimed locking device for a wire line core drilling system and method for core drilling. No relevant combination of the cited documents would lead a person skilled in the art to the invention defined in the claims.

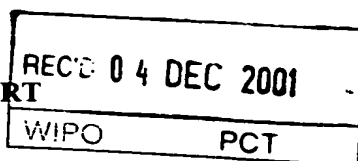
Therefore, the invention defined in claims 1-10 is novel and is considered to involve an inventive step. It is also considered to be industrially applicable.

# PATENT COOPERATION TREATY

# PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)



Applicant's or agent's file reference P 00-1133 IJW/uh	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
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Date of submission of the demand  12.03.2001	Date of completion of this report  23.11.2001
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer  Christer Bäcknert / MRo Telephone No. 08-782 25 00



**I. Basis of the report****1. With regard to the elements of the international application:\***

- ☒ the international application as originally filed
- ☐ the description:  
pages \_\_\_\_\_, as originally filed  
pages \_\_\_\_\_, filed with the demand  
pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☐ the claims:  
pages \_\_\_\_\_, as originally filed  
pages \_\_\_\_\_, as amended (together with any statement) under article 19  
pages \_\_\_\_\_, filed with the demand  
pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☐ the drawings:  
pages \_\_\_\_\_, as originally filed  
pages \_\_\_\_\_, filed with the demand  
pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☐ the sequence listing part of the description:  
pages \_\_\_\_\_, as originally filed  
pages \_\_\_\_\_, filed with the demand  
pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

**2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.**

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- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
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- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
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- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheet/fig \_\_\_\_\_

**5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).\*\***

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

\*\* Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/SE00/01630

## V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

### 1. Statement

Novelty (N)	Claims	<u>1-10</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-10</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-10</u>	YES
	Claims		NO

### 2. Citations and explanations (Rule 70.7)

Documents cited in the International Search Report:

1. US 3777826 A
2. GB 992246 A
3. US 5799742 A

These documents represent background art.

The invention defined in claims 1-10 is not disclosed by any of these documents.

None of the cited documents gives any indication towards the claimed locking device for a wire line core drilling system and method for core drilling. No relevant combination of the cited documents would lead a person skilled in the art to the invention defined in the claims.

Therefore, the invention defined in claims 1-10 is novel and is considered to involve an inventive step. It is also considered to be industrially applicable.

## PCT REQUEST

Original (for SUBMISSION) - printed on 24.08.2000 09:32:26 AM

0 0-1	For receiving Office use only International Application No.	PCT/SE 00 / 0 1 6 3 0
0-2	International Filing Date	2 4 -08- 2000
0-3	Name of receiving Office and "PCT International Application"	The Swedish Patent Office PCT International Application
0-4 0-4-1	Form - PCT/RO/101 PCT Request Prepared using	PCT-EASY Version 2.91 (updated 01.07.2000)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	Swedish Patent Office (RO/SE)
0-7	Applicant's or agent's file reference	00-1133/IJW
I	Title of invention	A LOCKING DEVICE FOR A WIRE LINE CORE DRILLING SYSTEM, A WIRE LINE SYSTEM INCLUDING SAID DEVICE AND A METHOD FOR CORE DRILLING
II II-1 II-2 II-4 II-5	Applicant This person is: Applicant for Name Address:	applicant only all designated States except US ATLAS COPCO CRAELIUS AB . . S-195 82 MÄRSTA Sweden
II-6 II-7 II-8 II-9	State of nationality State of residence Telephone No. Facsimile No.	SE SE +46 8 591 78 540 +46 8 591 18 782
III-1 III-1-1 III-1-2 III-1-4 III-1-5	Applicant and/or inventor This person is: Applicant for Name (LAST, First) Address:	applicant and inventor US only BORG, Thomas . Johan Banérs väg 36 S-182 75 STOCKSUND Sweden
III-1-6 III-1-7	State of nationality State of residence	SE SE

## PCT REQUEST

Original (for SUBMISSION) - printed on 24.08.2000 09:32:26 AM

IV-1	<b>Agent or common representative; or address for correspondence</b> The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
IV-1-1	Name	L.A. GROTH & CO.KB
IV-1-2	Address:	Each of KARLSSON Leif, ASKERBERG Fredrik, EMTEDAL Artur, HOPFGARTEN Nils, JOHANSSON WEBBJÖRN Ingmari, KÄRN Ulf, LINDBLOM Erik J. Box 6107 Västmannagatan 43 S-102 32 STOCKHOLM Sweden
IV-1-3	Telephone No.	+46 8 729 91 00
IV-1-4	Facsimile No.	+46 8 31 67 67
IV-1-5	e-mail	info@groth.se
V	<b>Designation of States</b>	
V-1	<b>Regional Patent</b> (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AP: GH GM KE LS MW MZ SD SL SZ TZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT
V-2	<b>National Patent</b> (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AE AG AL AM AT (patent and utility model) AU AZ BA BB BG BR BY BZ CA CH&LI CN CR CU CZ (patent and utility model) DE (patent and utility model) DK DM DZ EE (patent and utility model) ES FI (patent and utility model) GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ PL PT RO RU SD SE SG SI SK (patent and utility model) SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW

## PCT REQUEST

Original (for SUBMISSION) - printed on 24.08.2000 09:32:26 AM

<b>V-5</b>	<b>Precautionary Designation Statement</b> In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.	
<b>V-6</b>	<b>Exclusion(s) from precautionary designations</b>	NONE
<b>VI-1</b>	<b>Priority claim of earlier national application</b>	
VI-1-1	Filing date	24 August 1999 (24.08.1999)
VI-1-2	Number	9903018-1
VI-1-3	Country	SE
<b>VI-2</b>	<b>Priority document request</b> The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	VI-1
<b>VII-1</b>	<b>International Searching Authority Chosen</b>	Swedish Patent Office (ISA/SE)
<b>VIII</b>	<b>Check list</b>	number of sheets      electronic file(s) attached
VIII-1	Request ✓	4      -
VIII-2	Description ✓	6      -
VIII-3	Claims ✓	3      -
VIII-4	Abstract ✓	1      p00-1033.txt
VIII-5	Drawings ✓	2      -
VIII-7	TOTAL	16 ✓
<b>VIII-8</b>	<b>Accompanying items</b>	paper document(s) attached      electronic file(s) attached
VIII-8	Fee calculation sheet	✓      -
VIII-16	PCT-EASY diskette	-      diskette
VIII-17	Other (specified):	Copy of Off.Action      -
<b>VIII-18</b>	<b>Figure of the drawings which should accompany the abstract</b>	1
<b>VIII-19</b>	<b>Language of filing of the international application</b>	English } Swedish
<b>IX-1</b>	<b>Signature of applicant or agent</b>	<i>Ingmar D. Webjörn</i>
IX-1-1	Name	L.A. GROTH & CO.KB
IX-1-2	Name of signatory	Ingmari Johansson Webjörn
IX-1-3	Capacity	Patent Attorney

## PCT REQUEST

Original (for SUBMISSION) - printed on 24.08.2000 09:32:26 AM

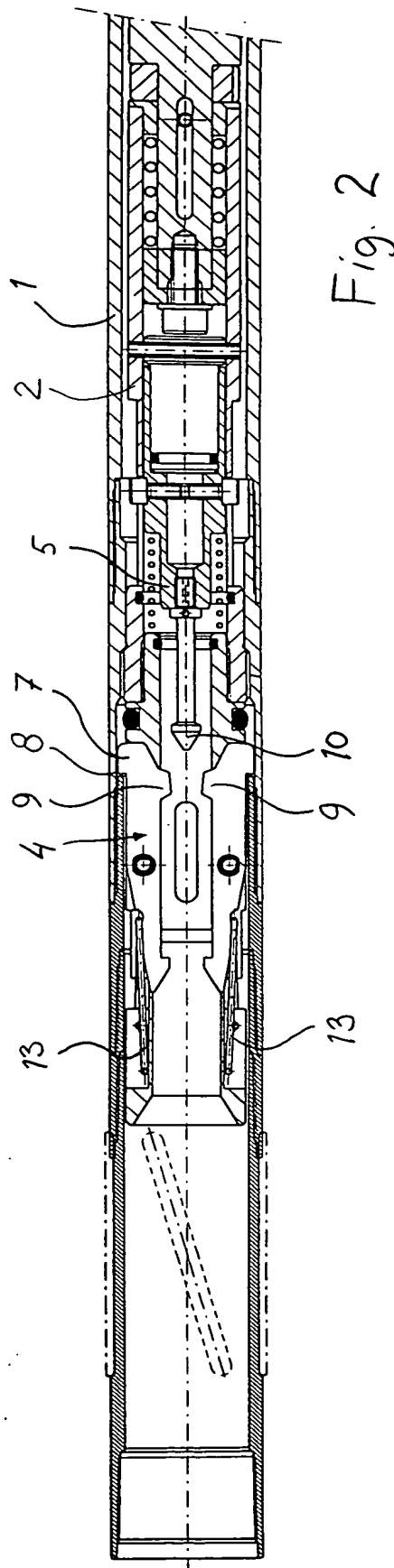
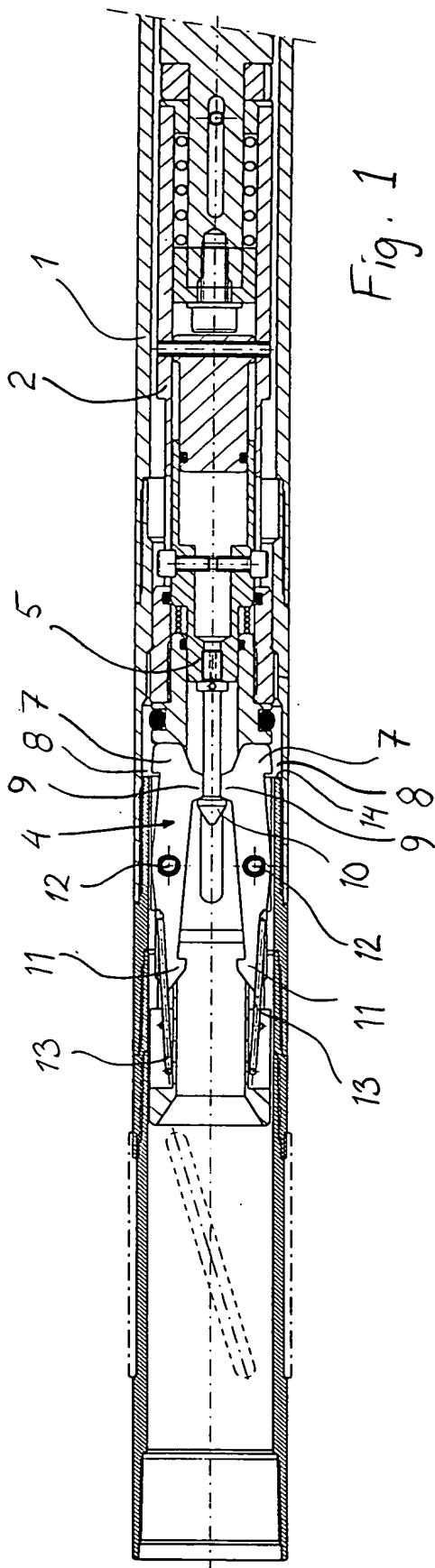
## FOR RECEIVING OFFICE USE ONLY

10-1	Date of actual receipt of the purported international application	24-08-2000
10-2	Drawings:	
10-2-1	Received <input checked="" type="checkbox"/>	
10-2-2	Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/SE
10-6	Transmittal of search copy delayed until search fee is paid	

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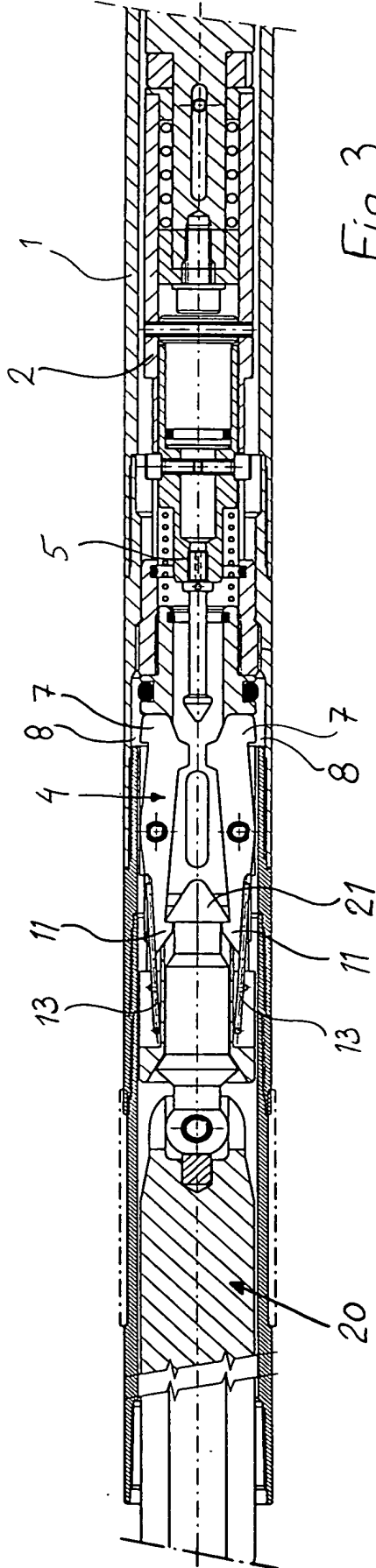


Fig. 3

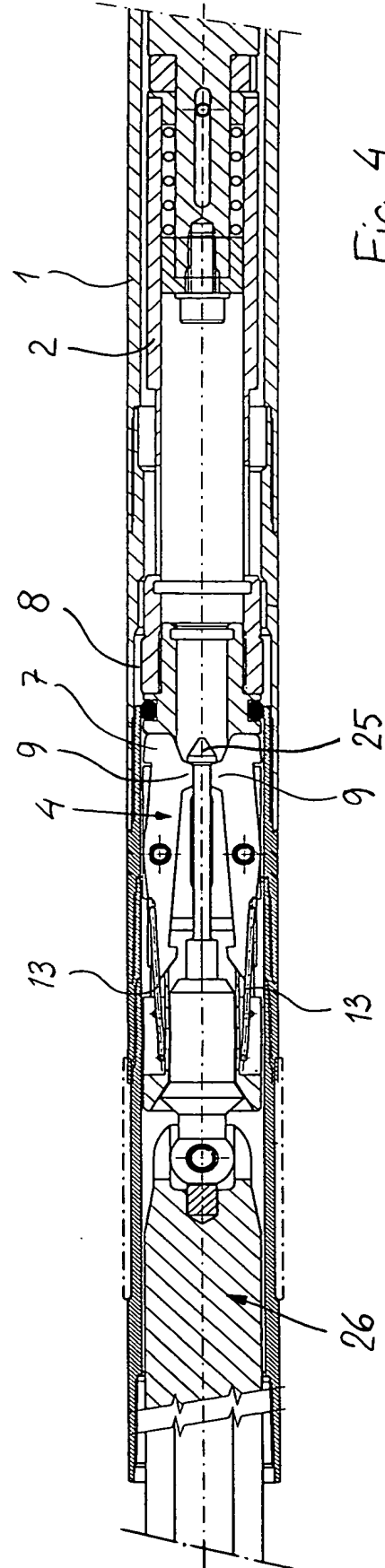


Fig. 4



# SPÄRRANORDNING FÖR LINKÄRNBORR, LINKÄRNBORRANORDNING INNEFATTANDE EN SPÄRRANORDNING OCH FÖRFARANDE VID LINKÄRNBORRNING

Föreliggande uppfinning avser en spärranordning för en linkärnborr i enlighet med ingressen till patentkravet 1, en linkärnborranordning innefattande en  
5 spärranordning enligt ingressen till kravet 9, samt ett förfarande vid linkärnborrning enligt ingressen till kravet 10.

Vid provborrningar för upptagande av bergartsprov från flera hundra och upp till ett par tusen meters djup används s.k. dubbla kärnrör med ett innerrör och ett ytterrör. Provet uppsamlas därvid i innerröret, som vanligtvis har en längd av  
10 några meter. När innerröret är fyllt detekteras detta vanligen med hjälp av en manometer eller motsvarande, som mäter spolvattentrycket i kärnröret. En i en lina upphängd fångstanordning nedsänks i röret för upptagning av innerröret med provet, vilken anordning innefattar ett griporgan i form av en fångklo, eller s.k. spear head, som är anordnad att komma i ingrepp med ett griporgan anordnat på/i inner-  
15 rörets övre ände. När linan därefter spänns lossnar innerröret från sitt ingrepp med ytterröret och innerröret med provet kan hissas upp. Omvänt kan fångklon och griporganet på innerröret användas för att fira ned ett nytt innerrör. En dylik typ av utrustning benämns vanligen wire line system.

När ett nytt innerrör införs är det viktigt att kunna konstatera att innerröret  
20 verkligen har nått ända ner i botten och intagit sitt rätta läge för borring innan borrar-ningen påbörjas. Som regel brukar man som indikation på att innerröret nått sitt rätta läge använda ett konstaterande att röret inte längre kan röra sig utan sitter fast. I enlighet med känd teknik är därför griporganet ofta konstruerat så att det är kombinerat med någon typ av spärrorgan som låser fast innerröret i förhållande till  
25 ytterröret när innerröret nått sitt rätta läge. Detta spärrorgan utgörs vanligen av någon, företrädesvis fjäderbelastad, hakliknande anordning, s.k. lås- eller spärrklo ("latch"), vilken går in i ingrepp med urtag eller ansatser anordnade på ytterrörets insida. Själva införandet av innerröret sker vanligen så att innerröret "pumpas" fram inuti borrarsträngen med hjälp av vatten, och/eller släpps ner med hjälp av gravita-  
30 tionskraften. Vid horisontella eller nära horisontella hål är det nödvändigt att "pumpa" fram röret. När innerröret väl sitter fast så kommer vattentrycket att öka så mycket att en ventil för ett spolmedium anordnad i innerröret frigörs.

Ett problem med dylika kända anordningar är att innerröret när det förs in i borrarsträngen ibland fastnar innan det har nått sitt rätta läge för borring. Med nuva-

rande konstruktion kommer då den vattentryckshöjning som sker att frigöra spol-  
ventilen innan innerröret nått sitt rätta läge och, i sämsta fall, påbörjas borringen  
och detta innebär framförallt en nackdel från ekonomisk synpunkt eftersom man då  
borrar "i tomme". Samma sak kan givetvis inträffa även när ett rör fastnar som man  
5 låter sjunka ned med hjälp av gravitationskraften och borringen startas eftersom  
man tror att innerröret är i rätt läge för borring. Det finns även en risk att kärnan  
på botten kan bli förstörd.

När innerröret är fullt och skall dras upp måste de spärrorgan i form av s.k.  
lås- eller spärrklor som håller fast innerröret i yterröret gå ur sitt ingrepp med ytter-  
10 röret. Detta sker vanligen genom att fångklon går i ingrepp med de griporgan som  
är förbundna med spärrorganet, vars spärrklor så dras in mot verkan av den fjä-  
derkraft som pressar ut dem för låsning mot yterröret. Det krävs således en viss  
reaktionskraft i systemet för att fjäderkraften skall övervinnas, vilket även ökar  
friktionen i den punkt där spärrklorna hakar i yterröret. Den idag vanligaste kända  
15 anordningen för att åstadkomma detta innefattar en hylsa som bidrar till att under-  
ifrån trycka ihop spärrklorna så att de ska släppa från yterrörets urtag, ansatser  
eller liknande. Även andra anordningar för att åstadkomma detta finns beskrivna  
exempelvis i US patentskrift 4,834,198 och svenskt patent, 320 941. Det sistnäm-  
da uppvisar särskilt nackdelen att griporgan och spärrorgan endast går i ingrepp i  
20 en enda punkt, vilket naturligtvis lätt leder till snedbelastningar med åtföljande pro-  
blem. På grund av de kända anordningarnas konstruktion, fjädrarnas och de olika  
grip- och spärrorganens placering så uppstår dock ibland problemet att spärrorga-  
net inte släpper från sitt ingrepp med yterröret utan sitter fast och förhindrar ut-  
dragning av innerröret med kärnprovet. Detta kan leda till betydande stillestånds-  
25 kostnader och även andra kostnader. I själva verket måste då hela borrarsträngen  
tas upp och vajern måste kapas i varenda rörskarv hos borrarsträngen. Detta är  
mycket tidsödande och kostsamt.

Föreliggande uppfinning har som främsta syfte att åtgärda ovan beskrivna  
problem genom en och samma anordning.

30 Syftet med uppfinningen uppnås medelst en spärranordning såsom är  
definierad i den kännetecknande delen av patentkravet 1, en linkärnborr såsom  
beskrivs i den kännetecknande delen av patentkravet 9 samt med ett förfarande  
som beskrivs i den kännetecknande delen av patentkravet 10.

I enlighet med föreliggande uppfinning innefattar således en spärranordning för ett innerrör spärrorgan utformade för att, när innerröret införts i ytterröret och intagit rätt position inuti ytterröret för borring, genom en och samma rörelse samtidigt åstadkomma mekanisk låsning av innerröret i förhållande till ytterröret och mekanisk frigöring av ett griporgan hos en medförd anordning förbunden med innerröret. Med uppfinningen erhålls således fördelarna att den medförda anordningen inte frigörs förrän innerröret har intagit rätt position inuti ytterröret för borring. Detta är särskilt fördelaktigt om t.ex. den medförda anordningen utgörs av en ventil för spolmedium, vilket är vanligt såsom beskrivits ovan. När ventilen frigörs så sker detta mekaniskt med hjälp av spärranordningen enligt uppfinningen. Den frigörs således inte på grund av någon tryckökning, och de risker som är förbundna med tidigare kända tryckutlösta anordningar, t.ex. att ventilen utlöses när röret fastnar, elimineras härmed. Spärranordningen enligt uppfinningen uppvisar även den fördelen att den kan användas tillsammans med en medförd anordning som utgörs av en införselanordning för införande av ett innerrör i ett ytterrör i ett torrt borrhål. Ett motsvarande förfarande definieras i kravet 10.

Vidare innefattar spärranordningen enligt föreliggande uppfinning företrädesvis griporgan för att, när innerröret skall utdragas ur ytterröret med hjälp av en fångstanordning innefattande griporgan och nämnda griporgan hos fångstanordningen kommer i kontakt med spärranordningens griporgan, genom en och samma rörelse gå i ingrepp med fångstanordningens griporgan och samtidigt frigöra innerroret från dess fastlåsning i förhållande till ytterröret. Uppfinningen visar således den ytterligare fördelen att spärranordningen och fångstanordningen går ur ingrepp med varandra samtidigt som innerröret frigörs från fastlåsningen i förhållande till ytterröret.

Föreliggande uppfinning uppvisar således den betydande fördelen att kunna uppfylla båda de funktioner som anges ovan, och den kan användas både i samband med en spolventil och vid ett torrt borrhål. Den innebär en både säkrare, enklare och mer ekonomisk lösning än vad som erbjuds med känd teknik.

Enligt en särskilt föredragen utföringsform innefattar spärranordningen åtminstone två delar, vilka var och en är lagrad svängbart i innerröret i radiell riktning runt en axel belägen mellan bakre utskott och främre utskott på respektive delar. Det är dessa utskott som fungerar som organ för att dels låsa fast innerröret i förhållande till ytterröret, dels gå i ingrepp med griporgan på fångstanordningen och

dels låsa fast respektive frigöra den medförda anordningen. Dessa utskott och övriga detaljer av uppfinningen kommer att beskrivas i den efterföljande detaljerade beskrivningen med hänvisning till ritningsfigurerna.

Uppfinningen avser även en linkärnborrordning innefattande en dylik  
5 spärranordning, såsom definieras i kravet 9.

Ytterligare kännetecken och fördelar framgår av underordnade patentkrav.

Uppfinningen kommer nu att beskrivas i detalj med hänvisning till bifogade ritningar, illustrerande ett icke-begränsande utföringsexempel av uppfinningen, på vilka:

- 10    Figur 1        visar en borrarsträng i längsgående genomskärning, försedd med en spärranordning enligt föreliggande uppfinning, vid införandet av ett innerrör,
- Figur 2        visar en borrarsträng i längsgående genomskärning, försedd med en spärranordning enligt föreliggande uppfinning, där innerröret har in-
- 15       tagit rätt position för borrarsträng och spolventilen har frigjorts,
- Figur 3        visar en borrarsträng i längsgående genomskärning, försedd med en spärranordning enligt föreliggande uppfinning, och illustrerar hur en fångstanordning införs i spärranordningen, och
- Figur 4        visar en borrarsträng i längsgående genomskärning, försedd med en
- 20       spärranordning enligt föreliggande uppfinning, där innerröret införs i ett torrt borrhål.

Borrarsträngen i figur 1 innefattar således ett yttorrör 1 förbundet med en borkkrona och ett innerrör 2, medelst vilken kärprov uppsamlas. Borrarsträngen sker i riktning åt höger i figuren, vilken betecknas som framåtriktningen. I innerrörets bak-

25 re del är en spärranordning 4 anordnad. I innerrörets bakre del är även en ventil 5 anordnad för spolmediet. Denna ventil kan med fördel vara av den typ som utgör föremålet för sökandens egen svenska patentansökan inlämnad samma dag som denna patentansökan. Vanligtvis utgörs spolmediet av vatten. Vid borrarsträng i riktning nedåt införs vanligen innerröret i borrarsträngen genom att det helt enkelt släpps

30 ned i borrarsträngen och får sjunka ned med hjälp av gravitationskraften, ända tills det kommer ner till rätt position inuti yttorröret för borrarsträng. När denna metod inte kan utnyttjas, exempelvis vid borrarsträng i huvudsakligen horisontell led eller i olika uppåtvinklar, så pumpas innerröret fram inuti borrarsträngen med hjälp av spolmedi-

et, företrädesvis vatten. Figur 1 illustrerar det läge när innerröret just har kommit fram till rätt position för borring, men ännu inte fastlåsts i förhållande till yterröret.

Spärranordningen, enligt det illustrerade utföringsexemplet, innefattar två delar eller halvor, och var och en av dessa delar innefattar två främre, i radiell riktning utåt riktade, utskjutande delar i form av utskott 7, företrädesvis med hakliknande form, vilka är utformade att gå i ingrepp med urtag 8 anordnade på yterrörets insida. Dessa främre utskott 7 kan jämföras med de spärrklor som finns på tidigare kända anordningar. Spärranordningen uppvisar även främre, i radiell riktning inåt riktade, utskott 9, utformade att gå i ingrepp med ett griporgan 10 förbundet med ventilens 5 rörliga del. Utskotten 9 kan även användas för att gå i ingrepp med ett griporgan hos en anordning för införande av ett innerrör i ett torrt borrhål, såsom beskrivs nedan i anslutning till figur 4. Slutligen är spärranordningen även försedd med bakre, i radiell riktning inåt riktade, utskott 11, företrädesvis med hakliknande form. Dessa utskott 11 är utformade att gå i ingrepp med griporgan hos en fångstanordning, såsom kommer att beskrivas mer i detalj nedan med hänvisning till figur 3.

Spärranordningens två delar är fjäderbelastade och svängbart lagrade i innerröret runt axlar 12 belägna mellan de bakre utskotten och de främre utskotten. Spärranordningen kan således svänga i väsentligen radiell riktning mot inverkan av två fjädrar 13, företrädesvis trådfjädrar. Varje del kan därför liknas vid en tvåarmad hävstång.

När innerröret med spärranordningen införs i yterröret intar de främre utåtriktade utskotten 7 ett intryckt eller hoptryckt läge varvid de glider mot borrhörets insida. När innerröret når fram till rätt position inuti yterröret för borring, såsom illustreras i figur 1, kommer utskotten 7 att befinna sig mitt för de urtag 8 som är anordnade i yterröret och kan, tack vare fjädrarna 13, fjädra ut och komma till anliggning mot yterröret. På detta sätt kommer innerröret att fasthållas i förhållande till yterröret. Detta utfjädrade tillstånd illustreras i figur 2. Urtagen 8 i yterröret är utformade med en ansats eller ett stopp 14, mot vilken den hakformade delen av utskottet kan anligga och härigenom förhindra att innerröret kan dras ut ur yterröret.

När utskotten 7 och hela det parti av spärranordningen som befinner sig framför axlarna 12 tillåts fjädra ut så kommer även utskotten 9 att förflytta sig i radiell riktning utåt, varigenom griporganet 10 förbundet med ventilens rörliga del frigörs och således frigörs även ventilen 5. Ventilens rörliga del kommer således att

förflytta sig och därigenom kommer ventilen att öppnas så att spolmedium fritt kan strömma genom innerröret. Detta framgår tydligt i figur 2.

I figur 3 illustreras hur spärranordningen 4 fungerar när utdragning av innerröret skall ske. En fångstanordning 20, vilken i sin främre del är försedd med ett griporgan 21, s.k. spear head, införs i borrhållningen. Fångstanordningens griporgan 21 är så utformat att det, när det når fram till den bakre änden på spärranordningen 4, tränger in mellan de bakre utskotten 11 och tvingar isär dessa, dvs tvingar dem i radiell riktning utåt mot fjädrarnas 13 verkan, varigenom de främre utåtriktade utskotten 7 förs inåt i radiell riktning och går ut ur sitt ingrepp med urtagen 8 i ytterröret. Innerröret är därvid fritt rörligt i axiell riktning. Griporganet 21 förs in mellan utskotten 11, med hakform, så långt att det går i ingrepp med dessa genom att anligga mot hakarna och spärras av dessa. Innerröret är således fritt att föras ut ur ytterröret genom att fångstanordningen dras ut. Ventilen 5 förblir hela tiden öppen under utdragandet vilket är en fördel ur trycksynpunkt.

I figur 4 illustreras slutligen hur spärranordningen 4 även kan användas vid införande av ett innerrör i ett torrt borrhål. De främre inåt riktade utskotten 9, vilka i figur 1 och 2 användes för att hålla griporganet 10 förbundet med ventilen, används här i stället för att gripa runt ett griporgan 25 förbundet med en anordning 26 för införande av ett innerrör. I figur 4 illustreras hur innerröret införs, innan det har kommit fram till det rätta läget för borrhållning, dvs innan utskotten 7 befinner sig mitt för urtagen 8 i ytterröret. Spärranordningens främre parti med utskotten 7 och 9 befinner sig således i sitt indragna läge. När innerröret når fram så långt att utskotten 7 befinner sig mitt för urtagen 8 så kommer spärranordningens främre parti att fjädra ut på samma sätt som illustreras i figur 2, varigenom utskotten 7 och 9 rör sig i radiell riktning utåt. Griporganet 25 hos införningsanordningen kommer således att frigöras och införningsanordningen kan dras tillbaka ut ur röret under det att innerröret hålls på plats i ytterröret, såsom beskrivits tidigare.

Föreliggande uppfinning är naturligtvis ej begränsad till den utföringsform som illustreras utan kan varieras på allehanda tänkbara sätt inom ramen för de bifogade patentkraven. T.ex. kan antalet delar varieras och även antalet utskott. I det illustrerade exemplet är vidare de två delarna försedda med var sin fjäder och är därmed helt oberoende av varandra men detta är inte nödvändigt för uppfinningstanken.

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## PATENTKRAV

1. Spärranordning för en linkärnborr innefattande ett innerrör (2) medelst vilket kärnprov uppsamlas och ett yterrör (1) förbundet med en borkrona, vilken spärranordning är anbringad i innerrörets bakre inre ände, **kännetecknad** av att spärranordningen (4) innefattar spärrorgan (7,9) utformade för att, när innerröret införs i yterröret och intagit rätt position inuti yterröret för borming, genom en och samma rörelse samtidigt åstadkomma mekanisk låsning av innerröret (2) i förhållande till yterröret (1) och mekanisk frigöring av ett griporgan (10; 25) hos en medförd anordning (5; 26) förbunden med innerröret.
2. Spärranordning enligt krav 1, **kännetecknad** av att spärranordningen även innefattar griporgan (11) för att, när innerröret (2) skall utdragas ur yterröret (1) med hjälp av en fångstanordning (20) innefattande griporgan (21) och nämnda griporgan hos fångstanordningen kommer i kontakt med spärranordningens griporgan (11), genom en och samma rörelse gå i ingrepp med fångstanordningens griporgan (21) och samtidigt frigöra innerröret (2) från dess fastlåsning i förhållande till yterröret (1).
3. Spärranordning enligt krav 1 eller 2, **kännetecknad** av att nämnda spärrorgan innefattar åtminstone två främre, i radiell riktning utåt riktade, utskott (7) och åtminstone två främre, i radiell riktning inåt riktade, utskott (9), vilka främre utåtriktade utskott (7) är ägnade att åstadkomma låsning av innerröret (2) i förhållande till yterröret (1) och vilka främre inåtriktade utskott (9) är ägnade att låsa fast griporganet (10 ;25) hos den medförda anordningen (5; 26) under införandet i yterröret och frigöra griporganet (10 ;25) hos den medförda anordningen när innerröret intagit rätt position i yterröret för borming.
4. Spärranordning enligt krav 3, **kännetecknad** av att den innefattar åtminstone två delar, att var och en av dessa delar innefattar åtminstone ett vardera av nämnda utskott (7,9), och att var och en av nämnda delar är lagrad svängbart i innerröret (2) i radiell riktning runt en axel (12) belägen mellan spärranordningens griporgan (11) och dess främre utskott (7,9), så att de främre utskotten kan svänga utåt i radiell riktning samtidigt som spärranordningens griporgan (11) kan svänga

inåt och vice versa, varvid de främre utåtriktade utskotten (7) åstadkommer låsning av innerröret (2) i förhållande till yterröret (1) genom att svänga utåt genom öppningar anordnade i innerröret och gå i ingrepp med urtag (8) anordnade på yterrörets insida, samtidigt som de främre inåtriktade utskotten (9) även svänger utåt och  
5 mekaniskt frigör griporganet (10 ;25) hos den medförda anordningen (5; 26) när innerröret intagit rätt position i yterröret för borring.

5. Spärranordning enligt krav 3 eller 4, **kännetecknad** av att, för utdragning av innerröret, fångstanordningens (20) griporgan (21) tvingar spärranordningens grip-  
10 organ (11) att svänga utåt så att de går i ingrepp med fångstanordningens griporgan och de främre utskotten (7,9) därigenom svänger inåt så att de främre utåtriktade utskotten (7) går ur sitt ingrepp med nämnda urtag (8) i yterröret och således frigör innerröret från dess fastlåsning i förhållande till yterröret.

15 6. Spärranordning enligt krav 5, **kännetecknad** av att spärranordningens griporgan innefattar åtminstone två bakre, i radiell riktning inåt riktade, utskott (11).

7. Spärranordning enligt något av kraven 3-6, **kännetecknad** av att nämnda innerrör (2) hos linkärnborren är försett med en ventil (5) för spolmedium, och att  
20 nämnda främre inåtriktade utskott (9) är ägnade att mekaniskt låsa fast och mekaniskt frigöra ett griporgan ((10) förbundet med nämnda ventil, varigenom ventilen öppnas.

8. Spärranordning enligt något av kraven 3-6 , **kännetecknad** av att nämnda  
25 medförda anordning är en införselanordning (26) för införande av ett innerrör (2) i ett yterrör (1), vilken är försedd med griporgan (25), och att nämnda främre inåtriktade utskott (9), är utformade att i sitt inåtsvängda läge under införandet av innerröret (2) i yterröret (1) vara i ingrepp med nämnda införselanordnings griporgan (25), och vilka intar sitt utåtsvängda läge när innerröret intagit rätt position inuti  
30 yterröret för borring, varigenom spärranordningen går ur sitt ingrepp med införselanordningens griporgan (25) som därmed kan avlägsnas tillsammans med tillhörande införselanordning.



9. Linkärnbörnanordning innefattande ett innerrör (2) medelst vilket kärnprov uppsamlas och ett yterrör (1) förbundet med en borrkrona, **kännetecknad** av att den är försedd med en spärranordning (4) i enlighet med något av kraven 1-8.

- 5 10. Förfarande vid linkärnbörning med en linkärnborr innefattande ett innerrör medelst vilket kärnprov uppsamlas och ett yterrör förbundet med en borrkrona, vilket innerrör är försett med en spärranordning för att sätta innerröret på plats i yterröret i rätt position för börning och låsa fast innerröret i förhållande till yterröret i nämnda rätta position medelst första spärrorgan, **kännetecknat** av att
- 10 – innerröret införs i yterröret, varvid nämnda första spärrorgan befinner sig i ett indraget läge och andra spärrorgan hos spärranordningen mekaniskt låser fast ett griporgan hos en medförd anordning förbunden med innerröret under införandet, ända tills innerröret intagit rätt position i yterröret, och
- 15 – när innerröret intagit rätt position i yterröret, spärranordningen genom en och samma rörelse samtidigt åstadkommer mekanisk låsning av innerröret mot yterröret och mekanisk frigöring av nämnda griporgan hos den medförda anordningen.
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## SAMMANDRAG

Uppfinningen avser en spärranordning (4) för en linkärnborr innefattande ett innerrör (2) medelst vilket kärnprov uppsamlas och ett ytterrör (1) förbundet  
5 med en borrhälskrona, vilken spärranordning är anbringad i innerrörets bakre ände. Spärranordningen (4) innefattar spärrorgan (7,9) för att, när innerröret införts i ytterröret och intagit rätt position inuti ytterröret för borming, genom en och samma rörelse samtidigt åstadkomma låsning av innerröret (2) i förhållande till ytterröret (1) och frigöring av ett griporgan (10; 25) hos en medförd anordning (5; 26) förbun-  
10 den med innerröret. Uppfinningen avser även ett förfarande samt en linkärnborrhälsanordning innefattande spärranordningen.

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(Fig. 1)

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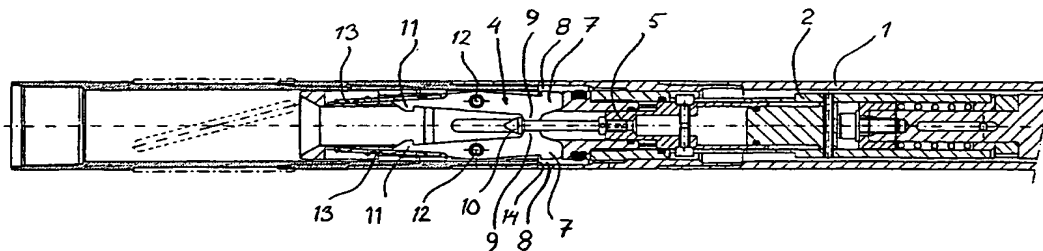
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(54) Title: **A LOCKING DEVICE FOR A WIRE LINE CORE DRILLING SYSTEM, A WIRE LINE SYSTEM INCLUDING SAID DEVICE AND A METHOD FOR CORE DRILLING**



(57) Abstract: The present invention relates to a locking device (4) for a wire line core drilling system comprising an inner tube (2) by means of which core samples are collected, and an outer tube (1) connected to a drill bit, which locking device is applied in the rear end of the inner tube. The locking device (4) comprises locking members (7, 9) so designed that, when the inner tube has been inserted into the outer tube and has assumed the correct position inside the outer tube for drilling, in one and the same movement it simultaneously effects mechanical locking of the inner tube (2) in relation to the outer tube (1) and release of a gripping means (10; 25) of an accompanying device (5; 26) connected to the inner tube.

**A LOCKING DEVICE FOR A WIRE LINE CORE DRILLING SYSTEM, A WIRE LINE SYSTEM INCLUDING SAID DEVICE AND A METHOD FOR CORE DRILLING**

5           The present invention relates to a locking device for a wire line core drilling system in accordance with the preamble to claim 1, a wire line core drilling system including a locking device in accordance with the preamble to claim 9, and a method of wire line core drilling in accordance with the preamble to claim 10.

10           When performing exploratory drilling to collect rock samples from depths of from several hundred to a couple of thousand meters, double core tubes are used having an inner and an outer tube. The sample is collected in the inner tube, which usually has a length of a few meters. When the inner tube is full this is usually detected by means of a manometer or the like that measures the flushing water pressure in the core tube. A retriever device suspended on a wire is lowered  
15 into the tube for retracting the inner tube with the sample, said retriever device comprising a gripping means in the form of a claw or "spear head" arranged to engage with a gripping means arranged on/in the upper end of the inner tube. When the wire is then tautened the inner tube is disengaged from the outer tube, and the inner tube with the sample can be hoisted up. Conversely, the claw and gripping  
20 means on the inner tube can be used to lower a new inner tube. Equipment of this type is generally known as a wire line system.

          When a new inner tube is inserted it is important to be able to ascertain that the inner tube really has reached right down to the bottom and has assumed its correct position for drilling, before drilling is commenced. Ascertainment that the  
25 tube cannot no longer move, but is firmly held is generally taken as an indication that the inner tube has reached its correct position. According to known technology, therefore, the gripping means is often designed to be combined with some type of locking member that firmly locks the inner tube in relation to the outer tube when the inner tube has reached the correct position. This locking member usually  
30 consists of a hook-like device, preferably spring-loaded, a locking claw or latch that engages with recesses or shoulders arranged in the inside of the outer tube. Actual insertion of the inner tube is usually performed by the inner tube being "pumped" along inside the drill string with the aid of water, and/or lowered with the aid of the force of gravity. In the case of horizontal, or substantially horizontal  
35 holes the tube must be pumped along. When the inner tube is firmly in place the water pressure will increase to such an extent that a valve arranged for flushing medium in the inner tube is released.

          One problem with such known arrangements is that when the inner tube is inserted into the drill string, it sometimes catches before it has reached the correct  
40 position for drilling. With designs currently in use the increase in water pressure

then occurring will release the flushing valve before the inner tube has reached its correct position and, in the worst case, drilling will be commenced. This primarily entails a disadvantage from the financial point of view since the drilling will be into thin air. The same thing may naturally occur when a tube that has been lowered by  
5 the force of gravity gets caught and drilling is commenced since it is assumed that the inner tube has reached the correct position for drilling. There is also a risk of the core at the bottom being destroyed.

When the inner tube is full and shall be retracted the locking means in the form of locking claws or latches retaining the inner tube in the outer tube must be  
10 disengaged from the outer tube. This is usually achieved by the retractor claw engaging with the gripping means connected to the locking device, the latches of which then being drawn in against the action of the spring force that is pressing them outwards to achieve locking against the outer tube. A certain reaction force is thus necessary in the system in order to overcome the spring force, which also in-  
15 creases the friction at the point where the latches hook into the outer tube. Currently the most usual known device for achieving this comprises a sleeve that contributes to compressing the latches from below so that they are released from the recesses, shoulders, or the like of the outer tube. Other devices used to achieve this are described, for instance, in US patent specification 4,834,198 and  
20 Swedish patent No. 320 941. The latter particularly reveals the drawback that gripping means and locking member are only engaged at one point, which naturally easily leads to load imbalances and problems associated therewith. Due to the design of the known devices, as the placing of the springs and the various gripping and locking members, however, the problem sometimes arises that the  
25 locking member is not released from its engagement with the outer tube, remaining caught there and preventing the inner tube from being retracted with the core sample. This may result in extensive standstill costs, as well as other costs. In fact, the complete drill string must then be taken up and the wire must be cut in every joint of the drill string. This is extremely time-consuming and expensive.

30 The primary object of the present invention is to remedy the problems described above by means of a single device.

The object of the invention is achieved by means of a locking device as defined in the characterizing part of claim 1, a wire line core drilling system as described in the characterizing part of claim 9, and a method as described in the characterizing part of claim 10.  
35

In accordance with the present invention, thus, a locking device for an inner tube comprises locking members so designed that, when the inner tube has been inserted into the outer tube and has assumed the correct position inside the outer tube for drilling, in one and the same movement it simultaneously effects

mechanical locking of the inner tube in relation to the outer tube and mechanical release of a gripping means of an accompanying device connected to the inner tube. The invention thus offers the advantages that the accompanying device is not released until the inner tube has assumed the correct position inside the outer tube for drilling. This is particularly advantageous if, for instance, the accompanying device comprises a valve for flushing medium, which is usual as described above. When the valve is released, this is achieved mechanically with the aid of the locking device in accordance with the invention. Thus, it is not released as a result of any pressure increase, and the risks entailed with previously known pressure-released arrangements, e.g. that the valve is released when the tube catches, are therefore eliminated. The locking device in accordance with the invention also has the advantage that it can be used together with an accompanying device consisting of an insertion device for inserting an inner tube into an outer tube in a dry drill hole. A corresponding method is defined in claim 10.

Preferably, the locking device in accordance with the invention also comprises gripping means which, when the inner tube is to be withdrawn from the outer tube with the aid of a retriever device comprising gripping means, and said gripping means of the retriever device come into contact with the gripping means of the locking device, in one and the same movement engage with the gripping means of the retriever device and simultaneously release the inner tube from its locked position in relation to the outer tube. The invention thus reveals the additional advantage that the locking device and catch are disengaged from each other at the same time as the inner tube is released from being locked in relation to the outer tube.

The present invention thus offers the important advantage of being able to fulfil both the functions described, and also of being able to be used both together with a flushing valve and in a dry drill hole. It constitutes a more reliable, simpler and more economic solution than has been available through known technology.

In accordance with a particularly preferred embodiment the locking device comprises at least two parts, each of which is journaled pivotably in the inner tube in radial direction about a shaft situated between rear protrusions and forward protrusions on respective parts. It is these protrusions that act as means for firmly locking the inner tube in relation to the outer tube, engage with gripping means on the retriever device and also firmly lock or release the accompanying device.

These protrusions and other components of the invention will be described in the following detailed description with reference to the drawings.

The invention also relates to a wire line core drill system including such a locking device, as defined in claim 9.

Additional features and advantages are revealed in the dependent claims.

The invention will now be described in detail with reference to the accompanying drawings, illustrating a non-limiting embodiment of the invention by way of example, in which:

Figure 1 shows a longitudinal section through a drill string provided with a locking device in accordance with the present invention, upon insertion of an inner tube,

Figure 2 shows a longitudinal section through a drill string provided with a locking device in accordance with the present invention, where the inner tube has assumed its correct position for drilling, and the flushing valve has been released,

Figure 3 shows a longitudinal section through a drill string provided with a locking device in accordance with the present invention, and illustrates how a retriever device is inserted into the locking device, and

Figure 4 shows a longitudinal section through drill string provided with a locking device in accordance with the present invention, where the inner tube is inserted into a dry drill hole.

The drill string in Figure 1 thus comprises an outer tube 1 connected to a drill bit, and an inner tube 2, by means of which core samples are collected. Drilling is performed towards the right in the drawing, this being designated the forward direction. A locking device 4 is arranged in the rear part of the inner tube. A valve 5 for flushing medium is also arranged in the rear part of the inner tube. This valve may preferably be of the type that is the subject of the applicant's own Swedish patent application, filed simultaneously with the present patent application. The flushing medium is generally water. When drilling in downward direction, the inner tube is usually inserted in the drill string by simply dropping it inside the drill string so that it falls by force of gravity until it reaches the correct position inside the outer tube for drilling. When this method cannot be used, e.g. when drilling substantially in horizontal direction or at various upward angles, the inner tube is pumped along inside the drill string with the aid of flushing medium, preferably water. Figure 1 illustrates the position when the inner tube has just reached the correct position for drilling but has not yet been locked in relation to the outer tube.

In accordance with the embodiment illustrated by way of example, the locking device comprises two parts or halves, and each of these parts comprises two forward protrusions 7, preferably with hook-like shape, directed radially outwards, which are designed to engage with recesses 8 arranged on the inside of the outer tube. These forward protrusions 7 may be compared with the latches on previously known devices. The locking device is also provided with forward protrusions 9 directed radially inwards and designed to engage with a gripping means 10 connected to the movable part of the valve 5. The protrusions 9 may also be used

to engage with a gripping means in an device for inserting an inner tube into a dry drill hole, as described below in conjunction with Figure 4. Finally the locking device is also provided with rear protrusions 11, preferably with hook-like shape, directed radially inwards. These protrusions 11 are designed to engage with gripping means of a retriever device, as will be described in detail below with reference to Figure 3.

The two parts of the locking device are spring-loaded and pivotably journalled in the inner tube about shafts 12 situated between the rear protrusions and the forward protrusions. The locking device can thus pivot in substantially radial direction, against the action of two springs 13, preferably wire springs. Each part can therefore be compared to a two-pronged lever.

When the inner tube with the locking device is inserted into the outer tube the forward, the outwardly directed protrusions 7 assume a retracted or compressed position and slide along the inside of the drill string. When the inner tube reaches the correct position inside the outer tube for drilling, as illustrated in Figure 1, the protrusions 7 will be opposite the recesses 8 arranged in the outer tube and, thanks to the springs 13, can spring out and into abutment with the outer tube. The inner tube will thus be firmly held in relation to the outer tube. This state, with rebounded springs, is illustrated in Figure 2. The recesses 8 in the outer tube are shaped with a shoulder or stop 14, against which the hook-shaped part of the protrusion can abut, thus preventing the inner tube from being withdrawn from the outer tube.

When the protrusions 7 and the entire portion of the locking device in front of the shafts 12 is permitted to rebound, the protrusions 9 will also move radially outwards so that the gripping means 10 connected to the movable part of the valve is released, and the valve 5 is thus also released. The movable part of the valve will therefore move, so that the valve is opened and flushing medium can flow freely into the inner tube. This is clear from Figure 2.

Figure 3 illustrates how the locking device 4 functions when the inner tube is to be withdrawn. A retriever device 20, provided at the front with a gripping means 21, a spearhead, is inserted into the drill string. The gripping means 21 of the retriever device is so designed that, when it reaches the rear end of the locking device 4, it penetrates between the rear protrusions 11, pushing them apart, i.e. forcing them radially outwards against the action of the springs 13. The forward, outwardly directed protrusions 7 are thus moved radially inwards and become disengaged from the recesses 8 in the outer tube. The inner tube is now freely movable in axial direction. The gripping means 21 is inserted between the hook-shaped protrusions 11, so far that it engages therewith by abutting the hooks and is locked thereby. The inner tube can thus be freely removed from the outer tube



by pulling the retriever device out. The valve 5 remains open throughout the withdrawal process, which is an advantage from the pressure aspect.

Finally, Figure 4 illustrates how the locking device 4 can also be used when inserting an inner tube into a dry drill hole. The forward, inwardly directed protrusions 9 which are used in Figures 1 and 2 to keep the gripping means 10 joined to the valve, are instead used here to grip around a gripping means 25 connected to a device 26 for insertion of an inner tube. Figure 4 illustrates how the inner tube is inserted, before it has reached the correct position for drilling, i.e. before the protrusions 7 have arrived opposite the recesses 8 in the outer tube. The front portion of the locking device, with protrusions 7 and 9 is thus in its retracted position. When the inner tube comes to the position where the protrusions 7 are opposite the recesses 8, the front portion of the locking device will rebound in the same way as illustrated in Figure 2, the protrusions 7 and 9 thus moving radially outwards. The gripping means 25 of the insertion device will thus be released and the insertion device can be withdrawn from the tube while the inner tube is kept in place in the outer tube, as described earlier.

The present invention is naturally not limited to the embodiment illustrated. It may be varied in many feasible ways within the scope of the appended claims. The number of parts may be varied, for instance, as well as the number of protrusions. In the example illustrated, furthermore, the two parts are provided with individual springs and are thus completely independent of each other. However, this is not necessary for the inventive concept.

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## CLAIMS

1. A locking device for a wire line core drill comprising an inner tube (2) by means of which core samples are collected, and an outer tube (1) connected to a drill bit, which locking device is applied in the rear end of the inner tube, **characterized** in that the locking device (4) comprises locking members (7, 9) so designed that, when the inner tube has been inserted into the outer tube and has assumed the correct position inside the outer tube for drilling, in one and the same movement it simultaneously effects mechanical locking of the inner tube (2) in relation to the outer tube (1) and mechanical release of a gripping means (10; 25) of an accompanying device (5; 26) connected to the inner tube.

2. A locking device as claimed in claim 1, **characterized** in that the locking device also comprises gripping means (11) that, when the inner tube (2) is to be retracted from the outer tube (1) with the aid of a retriever device (20) comprising gripping means (21), and said gripping means of the retriever device come into contact with the gripping means (11) of the locking device, in one and the same movement, shall engage with the gripping means (21) of the retriever device and simultaneously release the inner tube (2) from its locked position in relation to the outer tube (1).

3. A locking device as claimed in claim 1 or claim 2, **characterized** in that said locking device comprises at least two forward protrusions (7) directed radially outwards and at least two forward protrusions (9) directed radially inwards, said forward outwardly directed protrusions (7) being intended to achieve locking of the inner tube (2) in relation to the outer tube (1) and said forward inwardly directed protrusions (9) being intended to firmly lock the gripping means (10; 25) of the accompanying device (5; 26) during insertion into the outer tube, and to release the gripping means (10; 25) of the accompanying device when the inner tube has assumed its correct position in the outer tube for drilling.

4. A locking device as claimed in claim 3, **characterized** in that it comprises at least two parts, in that each of these parts comprises at least one of said protrusions (7, 9), and in that each of said parts is journaled pivotably in the inner tube (2) in radial direction about a shaft (12) situated between the gripping means (11) of the locking device and its forward protrusions (7, 9) so that the forward protrusions can pivot outwards in radial direction at the same time as the gripping means (11) of the locking device can pivot inwards, and vice versa, whereupon the forward outwardly directed protrusions (7) effect locking of the inner tube (2) in rela-

tion to the outer tube (1) by pivoting outwards through openings arranged in the inner tube and engage with recesses (8) arranged on the inside of the outer tube, at the same time as the forward inwardly directed protrusions (9) also pivot outwards and mechanically release the gripping means (10; 25) of the accompanying device (5; 26) when the inner tube has assumed the correct position in the outer tube for drilling.

5. A locking device as claimed in claim 3 or claim 4, **characterized** in that to achieve retraction of the inner tube, the gripping means (21) of the retriever device (20) forces the gripping means (11) of the locking device to pivot outwards so that they engage with the gripping means of the retriever device, and the forward protrusions (7, 9) thus pivot inwards so that the forward protrusions (7) disengage with said recesses (8) in the outer tube and thus release the inner tube from its locked position in relation to the outer tube.

6. A locking device as claimed in claim 5, **characterized** in that the gripping means of the locking device comprise at least two rear protrusions (11) directed radially inwards.

7. A locking device as claimed in any one of claims 3-6, **characterized** in that said inner tube (2) of the wire line core drill is provided with a valve (5) for flushing medium, and in that said forward inwardly directed protrusions (9) are designed to mechanically retain and mechanically release a gripping means (10) connected to said valve, whereupon the valve is opened.

8. A locking device as claimed in any one of claims 3-6, **characterized** in that said accompanying device is an insertion device (26) for inserting an inner tube (2) into an outer tube (1), which is provided with gripping means (25), and in that said forward inwardly directed protrusions (9) are designed, in their inwardly pivoted position and during insertion of the inner tube (2) into the outer tube (1), to be in engagement with the gripping means (25) of said insertion device, and assume their outwardly pivoted position when the inner tube has assumed the correct position inside the outer tube for drilling, whereupon the locking device is disengaged from the gripping means (25) of the insertion device, so that said means can be removed together with its insertion device.

9. A wire line core drill system comprising an inner tube (2) by means of which core samples are collected, and an outer tube (1) connected to a drill bit,

**characterized** in that it is provided with a locking device (4) as claimed in any one of claims 1-8.

10. A method for wire line core drilling using a wire line core drill comprising an inner tube by means of which core samples are collected, and an outer tube connected to a drill bit, which inner tube is provided with a locking device to position the inner tube in the correct position in the outer tube for drilling, and to firmly lock the inner tube to the outer tube in said correct position by means of first locking members, **characterized** in that
- 10 • the inner tube is inserted into the outer tube, whereupon said first locking members are in a retracted position and second locking members of the locking device mechanically lock a gripping means of an accompanying device connected to the inner tube during insertion, until the inner tube has assumed the correct position in the outer tube, and
  - 15 • when the inner tube has assumed the correct position inside the outer tube the locking device, in one and the same movement simultaneously effects mechanical locking of the inner tube to the outer tube and mechanical release of said gripping means of the accompanying device.
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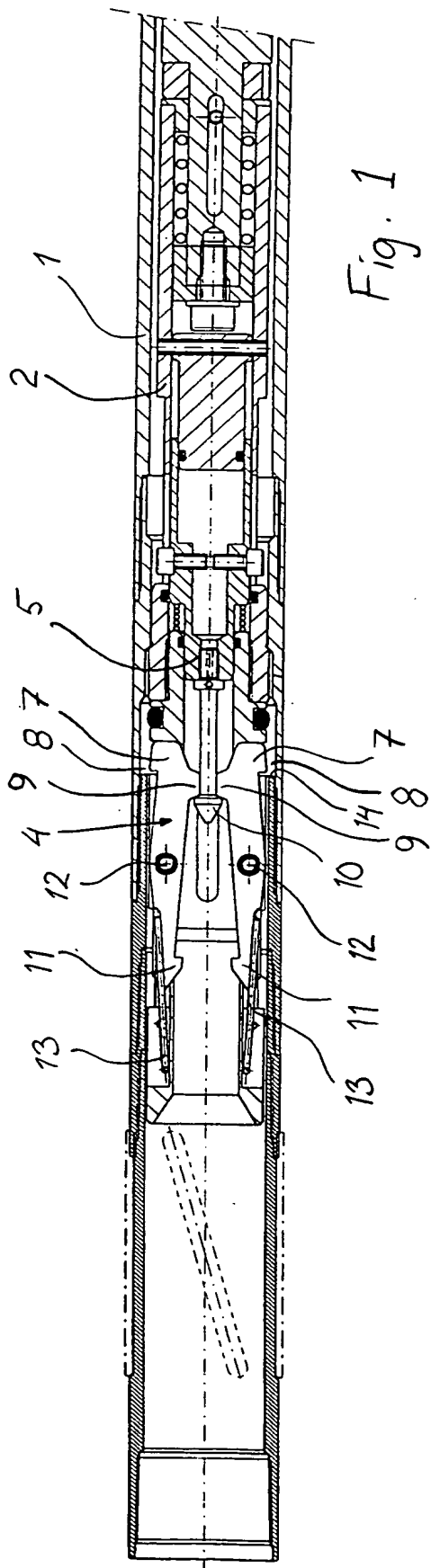


Fig. 1

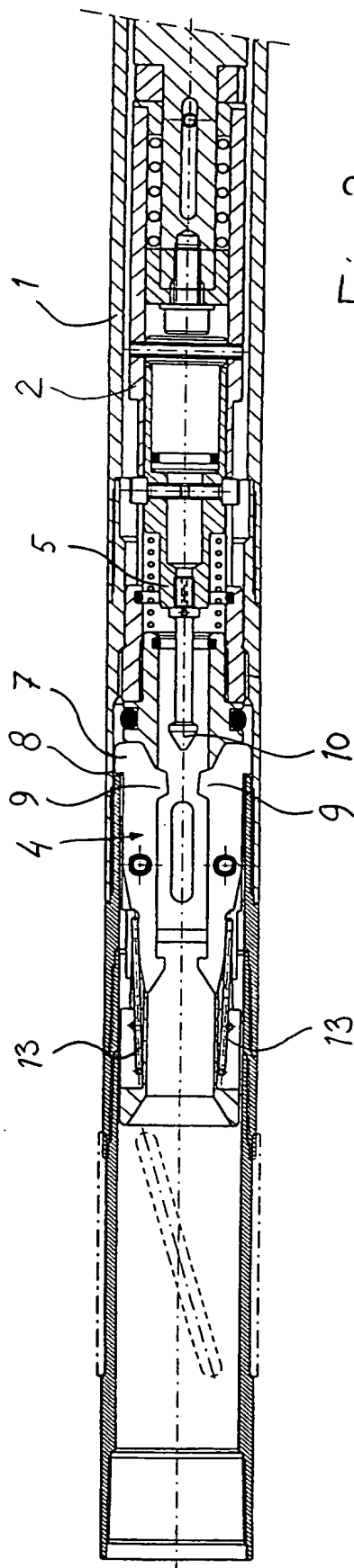
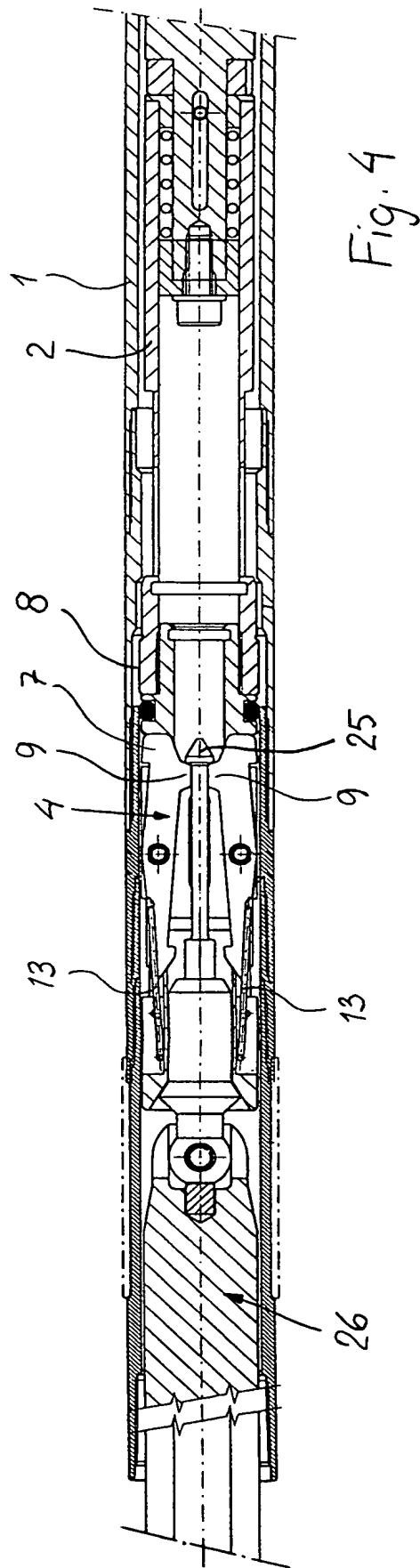
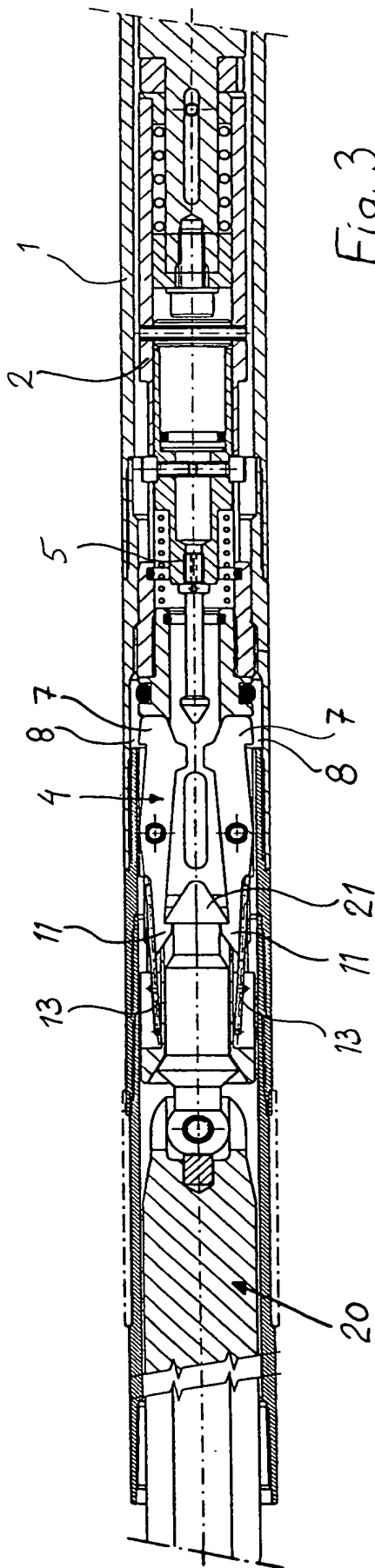


Fig. 2

2/2



# INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 00/01630

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: E21B 25/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3777826 A (WOLDA), 11 December 1973 (11.12.73) --	1-10
A	GB 992246 A (JOY MANUFACTURING COMPANY), 19 May 1965 (19.05.65) --	1-10
A	US 5799742 A (SOINSKI ET AL), 1 Sept 1998 (01.09.98) -- -----	1-10

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

\* Special categories of cited documents:

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.  
**PCT/SE 00/01630**

Patent document cited in search report			Publication date	Patent family member(s)		Publication date
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